Spring 5-13-2016

Association between Adolescent Substance Use and Weapon Carrying: Analysis of 2013 YRBS

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Abstract

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By

Samantha A. Bourque

April 26, 2016

Purpose: Substance use and weapon carrying among adolescents is a growing concern. The objective of this study is to investigate the association between adolescent substance use and weapon carrying using the 2013 Youth Risk Behavior Survey (YRBS).

Methods: Analyses were conducted using the 2013 YRBS, a nationally representative dataset sampling public and private high school students throughout the United States (US). Data from a total of 148,282 US adolescents were used in the present study.

Results: Two outcomes were assessed: weapon carrying within the past 30 days and weapon carrying on school property within the past 30 days. Among adolescents who carried a weapon, 77.3% were male, 62.7% were white, 28.5%% were in 9th grade, 33.8% used a tobacco product and 57.4% drank alcohol within the past 30 days, while 22.8% used a Schedule 1 drug and 14.0% used a Schedule 2 drug during their lifetime. Among adolescents who carried a weapon on school property, 74.4% were male, 55.1% were white, 26.5% were in 11th grade, 40.1% used a tobacco product and 61.9% drank alcohol within the past 30 days, while 32.1% used a Schedule 1 drug and 26.9% used a Schedule 2 drug during their lifetime. For the multivariable model predicting adolescent weapon carrying, tobacco use (adjusted odds ratio (AOR) = 2.31, 95% CI: 2.06, 2.59), alcohol use (AOR = 2.04, 95% CI: 1.81, 2.29), and Schedule 2 drug use (AOR = 2.27, 95% CI: 1.83, 2.80) were significantly associated with increased risk of carrying a weapon, adjusting for all covariates in the model simultaneously. For the multivariable model

predicting adolescent weapon carrying on school property, tobacco use (AOR = 2.33, 95% CI: 1.89, 2.86), alcohol use (AOR = 2.53, 95% CI: 2.02, 3.18), and Schedule 2 drug use (AOR = 2.58, 95% CI: 1.94, 3.43) were significantly associated with increased risk of carrying a weapon on school property, adjusting for all covariates in the model. Raw counts and weighted frequencies are reported.

Conclusions: Statistically significant associations between adolescent substance use and weapon carrying were found, suggesting that adolescent substance use is associated with increased weapon carrying behavior, both off and on school property. Future weapon carrying prevention efforts should target not only adolescents who are high risk for weapon carrying, but also those who are at risk for misusing substances.

Keywords: Adolescents; Substance use; Weapon carrying; Weapon carrying on school property

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B.S., The University of Georgia

A Thesis Submitted to the Graduate Faculty

of Georgia State University in Partial Fulfillment

of the

Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA

30303

Approval Page

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Acknowledgments

I would like to share my gratitude for Dr. Michael Eriksen's patience and encouragement, and for Drs. Terry Pechacek and Matthew Hayat's insightful feedback. Thank you all for being such a wonderful thesis committee! I would also like to thank my wonderful family and fiancé for their support, encouragement, and love!

Author's Statement Page

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Introduction

Background

Youth violence has been a public health concern for decades, where a prominent indicator is weapon carrying [1]. Since 1998, there has been a decline in adolescent bullying and physical fighting in the United States (US); however, this same pattern was not observed for weapon carrying [2].

Death by firearms occurs more frequently in the US than anywhere else in the industrialized world [3, 4] and since the end of the 1990s, the phrase 'school violence' has taken on a new meaning [5]. From 1990 until 2014, there were more than 190 documented shootings on school property in the US alone [6]. In 2011, approximately 1 in 20 students in grades 9-12 reported taking a weapon to school, and 7.4% were either threatened or injured with a weapon while at school [7]. The fear of victimization is coming through in school attendance as well. Included in the same report, almost 6% of US students in grades 9-12 missed school on at least one occasion in the previous 30 days because of safety concerns [7].

In understanding why this is happening, several social factors and risk behaviors need to be considered in better understanding the mindset of those that choose to carry weapons, even on school property. Although a number of studies have considered bullying, relationships, socioeconomic status, race, and past traumas, the researcher could only find two studies that have specifically considered substance use [8, 9] as a predictor of adolescent weapon carrying.

Monitoring the trends, the US Centers for Disease Control and Prevention's (CDC) Youth Risk Behavior Survey (YRBS) has been assessing youth risk behaviors across America since 1991. This survey has been the primary source of data to measure 20 *Healthy People 2020* objectives, which provide a comprehensive agenda for improving the health of all persons in the

US during 2011-2020 [10]. As yet, little is known about weapon carrying by adolescents who do, in fact, use substances. This lack of knowledge is a cause for concern given the potentially serious consequences this behavior carries for adolescent physical and mental health.

Purpose of Study

It has become increasingly important to understand the social factors and risk behaviors of those who choose to carry weapons, especially those who partake in substance use, due to the recent incidents of school violence. The objective of this study is to investigate the association between adolescent substance use and weapon carrying using the 2013 YRBS.

Research Questions

- Are adolescents who use substances more likely to carry a weapon?
- Are adolescents who use substances more likely to carry a weapon on school property?
- Which substances are mostly associated with weapon carrying?

Review of the Literature

Substance Use

While substance use among high school students seems to be on the decline in the US, the problem of adolescent use and abuse still exists and is far from going away [11].

Tobacco. Cigarette smoking is the leading preventable cause of death in the US, killing almost one in five people [12]. Tobacco use is started and established primarily during adolescence, where almost 9 out of 10 cigarette smokers tried smoking by age 18 [13]. Tobacco use at any age can result in a lifelong pattern of nicotine dependence and increased risk for cardiovascular disease, stroke, and lung cancer [12].

In 2013, the YRBS found that within the past 30 days of taking the survey, 15.7% of students smoked cigarettes, 5.6% smoked cigarettes frequently (on 20 or more days), 4.0%

smoked cigarettes on all 30 days, 3.8% smoked cigarettes on school property, 12.6% used cigars, and 8.8% used smokeless tobacco such as snuff [10]. The decline of cigarette smoking has continued and is at an all time low; however, the prevalence of newer products, such as electronic cigarettes, is now higher than the prevalence of cigarette smoking [11].

Gender and racial differences exist in the use of cigarettes, cigars, and smokeless tobacco products. Adolescent males are more likely than adolescent females to use cigars and smokeless tobacco products, but not cigarettes. Non-Hispanic students are more likely to use cigarettes and smokeless tobacco products than non-Hispanic black students and Hispanic students. Hispanic students are more likely to report using smokeless tobacco than non-Hispanic black students. There are no significant differences among the three racial groups when it came to cigar use [10].

When looking at the trend in multiple tobacco product use among current tobacco users, the prevalence of the concurrent use of cigars and smokeless tobacco significantly increased between 1999 and 2013 from 1.2% to 3.9% [14]. Trends like this may be attributed to striking changes in the tobacco marketplace occurring over the past decade, including the introduction of diverse products and flavorings that appeal to teens [15].

In reducing and preventing youth tobacco initiation and use, there are a number of practices that have been shown to be effective when implemented together. These include higher costs for tobacco products, prohibiting smoking in indoor areas, raising the minimum age of sale for tobacco products to 21 years, advertisements targeted toward youth to counter tobacco product advertisement, and community programs encouraging tobacco-free environments and reducing tobacco advertising [13].

Alcohol. Alcohol is the most commonly used and abused drug among youth in the US [16], and represents one of the most widespread types of risky behavior. More than 4,300 deaths

among underage youth are attributed to excessive drinking each year [17]. People aged 12 to 20 years drink 11% of all alcohol consumed in the US, where more than 90% of this alcohol is consumed in the form of binge drinks [18]. Adolescents who drink alcohol are more likely to experience social, legal, and physical problems; unwanted, unplanned, and unprotected sexual activity; physical and sexual assault; memory problems; abuse of other drugs; and death from alcohol poisoning [16].

Within the past 30 days of taking the survey, the 2013 YRBS found that 34.9% of high school students drank alcohol and 20.8% had five or more drinks of alcohol in a row (within a couple of hours on at least one day) [10]. In addition, 10% drove after drinking alcohol and 22% rode with a driver who had been drinking alcohol [10].

The odds of ever having a drink of alcohol were 9.9 times greater for students who used one tobacco product and 29.2 times greater for students who used multiple tobacco products than for those who did not use any tobacco products [14]. As concurrent use of tobacco products increase, so does the likelihood of consuming alcohol.

Reducing underage drinking requires community-based efforts to monitor the activities of youth and decrease youth access to alcohol [16]. Enforcement of minimum legal drinking age laws, national media campaigns targeting youth and adults, reducing youth exposure to alcohol advertising, and increasing alcohol excise taxes are a few prevention strategies for the prevention of underage drinking [16].

Schedule 1 Substances. Substances that are classified as Schedule 1 by the Drug Enforcement Administration (DEA) have no currently accepted medical use in the US, a high potential for abuse, and a lack of accepted safety for use under medical supervision [19]. These include heroin, lysergic acid diethylamide (LSD), marijuana (cannabis), peyote, methaqualone,

and 3,4-methylenedioxymethamphetamine ("ecstasy") [19]. For the purposes of this study, the researcher is looking at heroin, marijuana, and ecstasy use combined to represent Schedule 1 drugs.

In the 2013 YRBS, when asked about Schedule 1 drug use during their lifetime, 2.2% of adolescents used heroin, 23.4% used marijuana, and 6.6% used ecstasy [10]. The odds of ever using heroin were 4.7 times greater among students who used more than one tobacco product than for those who currently used one tobacco product [14].

In 2014, use of marijuana in 8th, 10th, and 12th grades declined from 2013; however, attitudes moved toward greater acceptance, meaning perceived risk of regular marijuana use declined [20]. Use of ecstasy also declined; however, heroin remained steady from 2013 to 2014 [20].

Schedule 2 Substances. Substances that are classified as Schedule 2/2N by the DEA have a high potential for abuse, which may lead to severe physical or psychological dependence [19]. Schedule 2 narcotics include hydromorphone (Dilaudid®), methadone (Dolophine®), meperidine (Demerol®), oxycodone (OxyContin®, Percocet®), and fentanyl (Sublimaze®, Duragesic®), morphine, opium, codeine, and hydrocodone. Examples of Schedule 2N stimulants include amphetamine (Dexedrine®, Adderall®), methamphetamine (Desoxyn®), and methylphenidate (Ritalin®) [19]. For the purposes of this study, the researcher is looking at cocaine and methamphetamine use combined to represent Schedule 2 drugs.

When asked about Schedule 2 drug use during their lifetime, 5.5% of 2013 YRBS respondents used some form of cocaine and 3.2% used methamphetamines [10]. For students who used more than one tobacco product, the odds of ever using methamphetamines were 28.9 times greater than for students who did not use any tobacco products [14].

From 2013 to 2014, use of cocaine and methamphetamines remained the same among adolescents, after declining over the past decade [20].

Weapon Carrying

Carrying a weapon can be categorized as an aggressive act or an act of self-defense in response to victimization [21]. Others argue that adolescent weapon carrying may be one aspect of a more generally delinquent lifestyle as manifested, for example, in its association with substance use [22 – 24]. A study conducted in Switzerland found that students who only carried a weapon had elevated risk for victimization and did not have the elevated risk for negative health behaviors, such as substance use, that was observed among students who used weapons in aggressive acts [8].

Weapon carrying is also shown to be associated with adverse mental, behavioral, and social health factors [25]. Those classified as weapon carriers who experienced victimization had a higher prevalence of carrying a gun or any weapon at school when compared to those who were classified as weapon carriers who did not experience victimization. In addition, weapon carriers without victimization were more likely to engage in substance use and other behavioral risk behaviors than weapon carriers with victimization. This suggests, contrary to the Swiss study [8], that weapon carriers with victimization are more likely to confront the same health risks more so than weapon carriers without victimization [25].

Across three countries – the Czech Republic, Russia, and the US – adolescent males were more likely to carry weapons with ratios being 1.7 in the US, 2.7 in Russia, and 3.4 in the Czech Republic. In the US, adolescent females who lived in single parent families had higher odds for weapon carrying compared to those with intact families. Further, substance use was associated

with significantly increased odds for weapon carrying among adolescent males in all of the countries [9].

The 2013 YRBS found that, nationwide, 17.9% of students had carried a weapon (e.g., gun, knife, or club), 5.5% had carried a gun, and 5.2% had carried a weapon on school property on at least one day during the 30 days before the survey [10]. In another cross-sectional study, physical fighting and weapon carrying were associated with an increased likelihood of injury that required medical attention [26].

Protective factors associated with weapon carrying were youth with positive family communication or parental monitoring. For Hispanic and white youth, having a relationship with the mother was prospectively associated with a lower likelihood of weapon carrying. For youth aged 14 to 17 years, the relationship with the father was prospectively associated with lower likelihood of weapon carrying. This highlights the protective influence of the parents' having a relationship with their children, knowing where their children are, whom their children are with, and what activities their children are engaging in [27].

Methods

Participants and Procedures

After excluding those with missing values for demographic variables, including gender (n = 942, 0.3%), race (n = 4,426, 2.2%), and grade (n = 1,998, 1.0%), the sample size was 148,282 adolescent students. Casewise deletion of demographic variables allowed for comparability across analyses and unbiased regression slope estimates. Of these students, 50.7% were male, most were white (55.1%), and 27.5% were in 9th grade. Further demographic characteristics of participants are described in Table 1.

This study used data from the YRBS Combined Datasets conducted by the CDC, which includes YRBS survey data from all national and the majority of weighted national, state, and large urban school district surveys conducted from 1991 to 2013. The YRBS monitors priority health risk behaviors that contribute to the leading causes of death, disability, and social problems among youth and adults in the US [28]. The YRBS is conducted biennially and uses a representative sample of 9th through 12th grade students in regular and private schools in the 50 states and the District of Columbia. This is done by utilizing a 3-stage cluster sample design [10]. For the purposes of this study, the researcher is using 2013 combined YRBS data, where all variables of interest are surveyed consistently.

The YRBS was administered nationally in the spring of 2013. Student participation was anonymous and voluntary, and parental permission was obtained in accord with local regulations. Students completed the self-administered questionnaire during one class period and recorded their responses directly on a computer-scannable booklet or answer sheet. Further details regarding the YRBS (study design, sampling methods, reliability, and validity) have been previously reported [10].

Measures

Tobacco use. The primary tobacco variables were use of cigarettes (smoked cigarettes ≥ one day during the past 30 days), smokeless tobacco (used smokeless tobacco ≥ one day during the past 30 days), and cigars, little cigars, and cigarillos (smoked cigars ≥ one day during the past 30 days). A fourth tobacco variable combined cigarette use, smokeless tobacco use, and cigar, little cigar, or cigarillo use in the past 30 days. The new variable was coded such that if any respondent answered "1 or more days" to any of the three questions, it was coded to "1 – Used

tobacco." If they answered "0 days" to any of the three questions, it was coded as "2 – Never used tobacco."

Alcohol use. The primary alcohol variable was use of alcohol (drank alcohol ≥ one day during the past 30 days).

Schedule 1 substances. The primary Schedule 1 drug variables were use of marijuana (used marijuana ≥ one day during the past 30 days), heroin (used heroin ≥ one day during lifetime), and ecstasy (used ecstasy ≥ one day during lifetime). A fourth variable combined the responses of the questions that included Schedule 1 drugs, as defined by the DEA [19]. These were heroin, marijuana, and ecstasy use during their lifetime, and were re-coded to "1 – Used drug" and "2 – Never used drug."

Schedule 2 substances. The primary Schedule 2 drug variables were use of methamphetamines (used methamphetamines ≥ one day during lifetime), and any form of cocaine (used cocaine ≥ one day during lifetime). A third variable combined the responses of the questions that included Schedule 2 drugs, which were cocaine and methamphetamines [19]. This variable used the same recode as the variable created for Schedule 1 drugs.

Weapon carrying. Primary outcome variables were weapon carrying such as gun, knife, or club (carried weapon ≥ one day during the past 30 days), and weapon carrying such as gun, knife, or club on school property (carried weapon on school property ≥ one day during the past 30 days). These variables will be referred to as "weapon carrying outcomes."

Demographics. Socio-demographic variables of interest were gender (male or female), race/ethnicity (American Indian/Alaska Native, Asian, Black or African American, Hispanic/Latino, Native Hawaiian/Other Pacific Islander, white, or multiple race (non-Hispanic)), and grade (9^{th}, 10^{th}, 11^{th}, or 12^{th}).

Student responses to the survey questions were dichotomized upon data collection. Therefore, both independent and dependent variables used in the present study were analyzed as dichotomous variables. Continuous variables were not used in the present study. Current use or weapon carrying was coded as "yes" if respondents selected at least one day as their response option, and lifetime use was coded as "yes" if respondents indicated they had used the drug at least once in their life. For the purposes of this study, the independent variables of interest are combined tobacco use, alcohol use, combined Schedule 1 drug use, and combined Schedule 2 drug use.

Statistical Analysis

All analyses were performed using SAS 9.3 [29]. Weighting procedures were used to correct for the sampling methodology, and compensated for student gender, race, and grade, nonresponse, and oversampling of black and Hispanic students [10]. Using the SAS SurveyFreq procedure, prevalence estimates and 95% confidence intervals (CIs) were calculated for substance use categories (used substances vs. did not use substances). Missing data was assumed missing completely at random, and casewise deletion of missing data occurred for demographic observations, weapon carrying (n = 21,563, 8.1%) and weapon carrying on school property (n = 20,186, 12.6%). Simple logistic regression was performed to evaluate the association of substance use on each weapon carrying outcome. Multivariable logistic regression to estimate the associations between each weapon carrying outcome and variables of interest was accomplished with a multivariable model including all covariates of interest. Akaike's Information Criteria (AIC) estimated a measure of the difference between a given model and the final model. Unadjusted and adjusted odds ratios (AORs) and 95% CIs were calculated; tables include raw counts and weighted percentages.

Results

The prevalence of weapon carrying and weapon carrying on school property varied across demographic variables (Table 2). Among those who carried a weapon, 77.3% were male, 62.7% were white, and 28.5%% were in 9th grade. Among those who carried a weapon on school property, 74.4% were male, 55.1% were white, and 26.5% were in 11th grade.

The type of substance used by adolescents also varied across demographic variables (Table 3). Of those who were male, 19.9% used a tobacco product and 43.4% drank alcohol within the past 30 days of taking the survey, while 15.6% used a Schedule 1 drug and 7.2% used a Schedule 2 drug at least once during their lifetime. American Indian/Alaska Natives were more likely to use tobacco, multiple race (non-Hispanic) adolescents were more likely to use alcohol, and Native Hawaiian/Other Pacific Islanders were more likely to use both Schedule 1 and Schedule 2 drugs than any other race. Tobacco use (22.1%), alcohol use (52.3%), Schedule 1 drug use (19.1%), and Schedule 2 drug use (7.2%) occurred more frequently in 12th graders than any other grade.

The researcher next examined the relationship between substance use and weapon carrying outcomes (Table 4). Among adolescents who carried a weapon, 33.8% used a tobacco product and 57.4% drank alcohol within the past 30 days of taking the survey, while 22.8% used a Schedule 1 drug and 14.0% used a Schedule 2 drug at least once in their lifetime. Among adolescents who carried a weapon on school property, 40.1% used a tobacco product and 61.9% drank alcohol within the past 30 days of taking the survey, while 32.1% used a Schedule 1 drug and 26.9% used a Schedule 2 drug at least once in their lifetime.

For the multivariable model predicting adolescent weapon carrying, tobacco use (AOR = 2.31, 95% CI: 2.06, 2.59), alcohol use (AOR = 2.04, 95% CI: 1.81, 2.29), and Schedule 2 drug

use (AOR = 2.27, 95% CI: 1.83, 2.80) were significantly associated with increased risk of carrying a weapon, adjusting for all covariates in the model (Table 5). In addition, adolescent males were more likely to carry a weapon than adolescent females (AOR: 4.08, 95% CI: 3.60, 4.62), controlling for all variables in the model. Asians (AOR = 0.30, 95% CI: 0.19, 0.48), Blacks or African Americans (AOR = 0.54, 95% CI: 0.46, 0.63), and Hispanic/Latinos (AOR = 0.53, 95% CI: 0.46, 0.62) were less likely to carry a weapon than whites, adjusting for all covariates in the model. Adolescents in 10^{th} (AOR = 0.85, 95% CI: 0.74, 0.99), 11^{th} (AOR = 0.79, 95% CI: 0.69, 0.91), and 12^{th} (AOR = 0.68, 95% CI: 0.59, 0.78) grades were less likely than 9^{th} grade adolescents to carry a weapon, controlling for all variables in the model.

For the multivariable model predicting adolescent weapon carrying on school property, tobacco use (AOR = 2.33, 95% CI: 1.89, 2.86), alcohol use (AOR = 2.53, 95% CI: 2.02, 3.18), and Schedule 2 drug use (AOR = 2.58, 95% CI: 1.94, 3.43) were significantly associated with increased risk of carrying a weapon on school property, adjusting for all covariates in the model (Table 6). Adolescent males (AOR = 2.73, 95% CI: 2.31, 3.23) were significantly associated with increased risk of carrying a weapon on school property than females, controlling for all variables in the model. Asians (AOR = 0.35, 95% CI: 0.22, 0.55), Blacks or African Americans (AOR = 0.70, 95% CI: 0.53, 0.91), and Hispanic/Latinos (AOR = 0.63, 95% CI: 0.47, 0.85) were less likely to carry a weapon on school property than whites, adjusting for all covariates in the model. No grade category was significantly associated with increased risk of carrying a weapon on school property, controlling for all variables in the model.

Discussion

The present study reports the first known data illustrating the relationship between substance use and weapon carrying among adolescents using the 2013 YRBS. The results

revealed that there is a higher chance of weapon carrying among adolescents who use substances. More specifically, tobacco, alcohol, and Schedule 2 drugs were associated with weapon carrying. However, when it came to carrying a weapon both off and on school property, Schedule 1 drug use was not associated with the weapon carrying outcomes.

In looking at the demographic characteristics by weapon carrying outcome, one in four males carried a weapon within the past 30 days of taking the survey. American Indian/Alaska Native and Native Hawaiian/Other Pacific Islander reported carrying weapons both off and on school property more frequently than any other race. One in four American Indian/Alaska Natives and one in three Native Hawaiian/Other Pacific Islanders carried a weapon within the past 30 days of taking the survey. One in fifteen American Indian/Alaska Natives and approximately one in seven Native Hawaiian/Other Pacific Islanders carried a weapon on school property within the past 30 days of taking the survey. This outcome could extend to be culturally significant among Natives, and is an area for future research. If results like this are found true in other research, then this can inform public health prevention efforts, while emphasizing that among the small population of Natives, weapon carrying occurs more frequently.

Across types of substances, adolescent males were more likely to use tobacco, Schedule 1, and Schedule 2 drugs than females. However, females reported using alcohol more than males, where approximately one in two females used alcohol within the past 30 days of taking the survey. Almost one in five American Indian/Alaska Natives and Native Hawaiian/Other Pacific Islanders reported using a tobacco product and one in two multiple race (non-Hispanic) adolescents used alcohol within the past 30 days of taking the survey. Among Native Hawaiian/Other Pacific Islanders, one in four reported using Schedule 1 drugs and one in eight used Schedule 2 drugs during their lifetime One in five 12th grade adolescents reported using

tobacco and approximately one in two 10th, 11th, and 12th grade adolescents reported using alcohol within the past 30 days of taking the survey. Among 12th grade adolescents, one in five reported using Schedule 1 drugs and one in fourteen used Schedule 2 drugs during their lifetime.

Of those who carried a weapon, one in three adolescents used tobacco and one in two adolescents used alcohol within the past 30 days of taking the survey. One in five adolescents used Schedule 1 drugs, while one in seven used Schedule 2 drugs during their lifetime. Of those who carried a weapon at school, approximately one in two adolescents used tobacco and two in three used alcohol within the past 30 days of taking the survey. One in three adolescents who carried a weapon at school used Schedule 1 drugs and one in four used Schedule 2 drugs. This implies that those who carry a weapon at school use substances more frequently than those who carry a weapon in general.

While tobacco, alcohol, and Schedule 2 drugs are significantly associated with weapon carrying, Schedule 1 drugs are not. The same pattern is observed for weapon carrying on school property. Schedule 2 drug use is mostly associated with weapon carrying on school property, followed by alcohol and tobacco use. This suggests that those who use more "risky" drugs may be more likely to take risks in other areas, such as weapon carrying, especially on school property.

Males are four times more likely to carry a weapon and almost three times more likely to carry a weapon on school property than females. American Indian/Alaska Natives, Native Hawaiian/Other Pacific Islanders, and multiple race (non-Hispanic) adolescents are not significantly associated with weapon carrying or weapon carrying on school property. However, Asians, Blacks or African Americans, and Hispanic/Latinos are less likely to carry a weapon both off and on school property than whites. Adolescents in 10th, 11th, and 12th grades are less

likely than 9th grade adolescents to carry a weapon. The odds decrease as grades rise, which could imply that as adolescents mature, they understand the risk associated with weapon carrying. Weapon carrying on school property was not significantly associated with grade.

There has been a disagreement in the literature regarding adolescent weapon carrying and whether it is a defensive reaction arising from fear or is a component of a more aggressive and/or delinquent lifestyle. One study found that adolescents who carry weapons as a solely defensive behavior are rare, and instead are acting in a 'defensive-aggressive' rather than 'defensive-fearful' manner [9]. This exemplifies that adolescents who carry weapons are not afraid to use them, and the importance of parents being involved in their child's life – addressing the situation before it turns bad. School counselors should also be aware of the weapon carrying literature and the information the present study provides.

Limitations. There are several limitations of this study that need to be considered with interpreting the findings. First, the data collected from the YRBS only apply to youth who attend school and, therefore, are not representative of all persons in this age group. Second, the extent of underreporting or overreporting of behaviors cannot be determined, although the survey questions demonstrate good test-retest reliability due to anonymity and administering the survey at school [32]. Third, causal inference is not plausible because these data are cross-sectional, meaning that temporality cannot be established. Lastly, removing the observations with missing demographic variables, and then those with missing weapon carrying outcome, can potentially bias the results.

Implications. The current study reinforces that health risk behaviors rarely occur in isolation, and that health-compromising behaviors, such as substance use and weapon carrying, tend to cluster. Public health intervention programs should target multiple risk behaviors.

Counseling on related risk factors should be a large part of any intervention involving weapon-carrying youth.

The majority of adolescents who chose to carry a weapon both off and on school property were male, white, and in 9th grade. This provides useful demographic information for public health prevention and intervention programs. It also allows for future research to look at social factors and risk behaviors occurring in young, white, adolescent males, and to also determine the socioeconomic status of this specific group.

Protective factors in prevention of substance use among adolescents include having a stable family, lower amount of pocket money, and good school performance [30]. Students with higher grades are less likely to engage in substance use behaviors than their classmates with lower grades. Conversely, students who do not engage in substance use behaviors receive higher grades than their classmates who do engage in substance use behaviors [31].

YRBS data is an important tool for planning, implementing, and evaluating public health policies, programs, and practices in schools and communities [10]. It is important to extend the results to examine what is currently ongoing, due to the changing environment of substance use among youth.

Future research should examine demographic characteristics, such as socioeconomic status and urbanicity, as it relates to the association between substance use and weapon carrying. In addition, longitudinal research can help explain temporality of this relationship, point to causal associations, and help identify other underlying social factors and risk behaviors.

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Table 1
Sample Characteristics*

Variable	N (%)	
Gender		
Male	72,437	(50.7)
Female	75,971	(49.3)
Race/Ethnicity		
American Indian/Alaska Native	3,198	(1.5)
Asian	6,950	(3.0)
Black or African American	22,848	(18.3)
Hispanic/Latino	24,016	(18.9)
Native Hawaiian/Other Pacific Islander	2,536	(0.6)
White	80,919	(55.1)
Multiple Race (Non-Hispanic)	7,941	(2.6)
Grade		
9th grade	41,348	(27.5)
10th grade	40,230	(25.5)
11th grade	35,766	(23.9)
12th grade	31,064	(23.0)
Total	148,408	

*Table includes raw counts and weighted percentages. Missing demographic observations were dropped: gender (942, 0.3%); race (4,426, 2.2%), and grade (1,998, 1.0%).

Table 2
Sample Characteristics by Weapon Carrying Outcomes*

Variable	Carried Weapon, N (%)			Carried Weapon at School, N (%)		
	Yes	No	Total	Yes	No	Total
Gender						
Male	16,362 (26.8)	44,937 (73.2)	61,299	4,706 (6.8)	57,689 (93.2)	62,396
Female	5,553 (7.9)	59,993 (92.1)	65,546	1,782 (2.4)	64,045 (97.6)	65,827
Race/Ethnicity						
American Indian/Alaska Native	608 (24.6)	2,016 (75.4)	2,624	198 (6.7)	2,725 (93.3)	2,923
Asian	500 (6.3)	5,831 (93.8)	6,331	162 (2.5)	5,046 (97.5)	5,208
Black or African American	2,666 (12.9)	18,613 (87.1)	21,279	949 (4.1)	19,543 (95.9)	20,492
Hispanic/Latino	3,422 (15.0)	17,814 (85.0)	21,236	1,283 (4.7)	19,765 (95.3)	21,048
Native Hawaiian/Other Pacific Islander	463 (27.2)	1,916 (72.8)	2,379	104 (15.1)	980 (84.9)	1,084
White	12,865 (19.9)	53,008 (80.1)	65,873	3,393 (4.7)	67,784 (95.3)	71,177
Multiple Race (Non-Hispanic)	1,391 (19.6)	5,732 (80.4)	7,123	399 (5.5)	5,891 (94.5)	6,290
Grade						
9th grade	6,187 (17.9)	29,452 (82.1)	35,639	1,471 (4.1)	33,841 (95.9)	35,312
10th grade	5,956 (17.3)	28,460 (82.7)	34,416	1,681 (4.5)	33,384 (95.5)	35,065
11th grade	5,203 (16.9)	25,234 (83.1)	30,437	1,702 (5.1)	29,140 (94.9)	30,842
12th grade	4,569 (17.3)	21,784 (82.7)	26,353	1,634 (4.9)	25,369 (95.1)	27,003
Total	21,915 (17.4)			6,488 (4.6)		

*Table includes raw counts and weighted percentages.

Missing observations for carrying a weapon were dropped (21,563, 8.1%); missing observations for carrying a weapon at school were dropped (20,186, 12.6%).

Table 3

Sample Characteristics by Substance Use*

Variable	Tobacco Use, N (%)	Alcohol Use, N (%)	Schedule 1 Drug Use, N (%)	Schedule 2 Drug Use, N (%)	Total
Gender					
Male	14,293 (19.9)	33,020 (43.4)	12,943 (15.6)	5,400 (7.2)	72,437
Female	9,762 (12.3)	37,421 (47.4)	11,245 (12.9)	3,205 (4.0)	75,971
Race/Ethnicity					
American Indian/Alaska Native	740 (21.8)	1,327 (43.1)	716 (18.9)	271 (7.4)	3,198
Asian	402 (4.8)	1,704 (26.0)	632 (7.5)	277 (3.4)	6,950
Black or African American	2,803 (11.3)	10,332 (42.4)	4,257 (14.8)	1,285 (4.9)	22,848
Hispanic/Latino	3,672 (14.4)	8,793 (46.2)	4,982 (19.7)	2,309 (9.7)	24,016
Native Hawaiian/Other Pacific Islander	266 (19.3)	568 (37.8)	686 (25.0)	267 (12.4)	2,536
White	14,939 (18.9)	43,739 (47.2)	11,383 (12.4)	3,710 (4.6)	80,919
Multiple Race (Non-Hispanic)	1,233 (15.0)	3,978 (47.6)	1,532 (14.8)	486 (4.7)	7,941
Grade					
9th grade	4,748 (11.5)	16,457 (37.5)	4,763 (10.1)	1,884 (4.3)	41,348
10th grade	5,896 (14.7)	18,291 (44.0)	6,224 (13.3)	2,132 (5.5)	40,230
11th grade	6,393 (17.4)	18,546 (49.2)	6,561 (15.6)	2,228 (5.8)	35,766
12th grade	7,018 (22.1)	17,147 (52.3)	6,640 (19.1)	2,361 (7.2)	31,064

*Table includes raw counts and weighted percentages.

Table 4

Prevalence of Substance Use Behaviors by Adolescents Who Carry Weapons*

	Carried Weapon, N (%)	Carried Weapon at School, N (%)
Tobacco Use		
Using any tobacco during past 30 days	7,666 (33.8)	2,855 (40.1)
Alcohol Use		
Drinking alcohol during past 30 days	13,631 (57.4)	4,254 (61.9)
Illicit Drug Use		
Using any Schedule 1 drug during lifetime	6,597 (22.8)	2,360 (32.1)
Using any Schedule 2 drug during lifetime	3,616 (14.0)	1,761 (26.9)
Total	21,915 (17.4)	6,488 (4.6)

*Table includes raw counts and weighted percentages.

Table 5
Logistic Regression Models for Weapon Carrying

	Unadjusted Model			Adjusted Model		
	OR	95% CI		OR	95% CI	
Variable	Estimate	Lower	Upper	Estimate	Lower	Upper
Tobacco Use						
Using any tobacco during past 30 days	4.21	3.92	4.53	2.31	2.06	2.59
	1.00			1.00		
Alcohol Use						
Drinking alcohol during past 30 days	2.63	2.44	2.84	2.04	1.81	2.29
	1.00			1.00		
Illicit Drug Use						
Using any Schedule 1 drug during lifetime	2.57	2.32	2.84	1.05	0.91	1.21
	1.00			1.00		
Using any Schedule 2 drug during lifetime	4.97	4.46	5.54	2.27	1.83	2.80
	1.00			1.00		
Gender						
Male	4.26	3.99	4.55	4.08	3.60	4.62
Female	1.00			1.00		
Race						
American Indian/Alaska Native	1.31	1.05	1.64	1.06	0.78	1.42
Asian	0.27	0.22	0.33	0.30	0.19	0.48
Black or African American	0.60	0.54	0.66	0.54	0.46	0.63
Hispanic/Latino	0.71	0.65	0.77	0.53	0.46	0.62
Native Hawaiian/Other Pacific Islander	1.50	1.16	1.95	0.77	0.36	1.69
Multiple Race (Non-Hispanic)	0.98	0.87	1.10	1.01	0.83	1.24
White	1.00			1.00		
Grade						
9th grade	1.00			1.00		
10th grade	0.96	0.87	1.06	0.85	0.74	0.99
11th grade	0.93	0.85	1.02	0.79	0.69	0.91
12th grade	0.96	0.89	1.04	0.68	0.59	0.78

Table 6

Logistic Regression Models for Weapon Carrying on School Property

	Unadjusted Model			Adjusted Model		
	OR	95% CI		OR	95% CI	
Variable	Estimate	Lower	Upper	Estimate	Lower	Upper
Tobacco Use						
Using any tobacco during past 30 days	5.77	5.06	6.58	2.33	1.89	2.86
	1.00			1.00		
Alcohol Use						
Drinking alcohol during past 30 days	4.55	3.78	5.46	2.53	2.02	3.18
	1.00			1.00		
Illicit Drug Use						
Using any Schedule 1 drug during lifetime	3.75	1.13	4.49	1.11	0.86	1.42
	1.00			1.00		
Using any Schedule 2 drug during lifetime	8.16	7.17	9.30	2.58	1.94	3.43
	1.00			1.00		
Gender						
Male	3.00	2.65	3.41	2.73	2.31	3.23
Female	1.00			1.00		
Race						
American Indian/Alaska Native	1.46	1.14	1.87	1.20	0.76	1.90
Asian	0.52	0.34	0.80	0.35	0.22	0.55
Black or African American	0.87	0.73	1.03	0.70	0.53	0.91
Hispanic/Latino	0.99	0.84	1.17	0.63	0.47	0.85
Native Hawaiian/Other Pacific Islander	3.60	2.24	5.81	1.70	0.61	4.73
Multiple Race (Non-Hispanic)	1.17	0.92	1.49	1.03	0.64	1.64
White	1.00			1.00		
Grade						
9th grade	1.00			1.00		
10th grade	1.09	0.95	1.25	1.00	0.78	1.27
11th grade	1.26	1.05	1.52	1.12	0.83	1.50
12th grade	1.19	1.03	1.38	0.81	0.61	1.09